ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 10, pp.60106-60110, October, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

REVIEW ARTICLE

GENETIC PARAMETERS AND EFFECT OF NON GENETIC FACTORS ON LIFETIME PERFORMANCE TRAITS OF MURRAH BUFFALO: A REVIEW

***Kapil Dev, Dhaka, S.S., Yadav, A.S., Patil, C.S. and Lalit**

Department of Animal Genetics and Breeding, LUVAS, Hisar-125004

ARTICLE INFO

Article History:
Received 18th July, 2017
Received in revised form
30th August, 2017
Accepted 13th September, 2017
Published online 31st October, 2017

Key words:
Lifetime traits, Murrah,
Genetic, Phenotypic parameters.

ABSTRACT

The success of Indian dairy industry is much dependent on productivity and efficient reproduction performance of Murrah buffaloes. .It is a established fact that first lactation yield is a good indicator of lifetime performance but still there is further need to study the relationship between first, later lactations and lifetime performance traits for overall better evaluation of genetic worth of the female individual's own performance and for ranking of sires. Economic return from dairy animals depends on lifetime performance. The prediction of expected correlated response to selection based on early performance and development of selection schemes for genetic improvement in lifetime traits are likely to be more beneficial. The impact of any selection programme depends upon degree of accuracy of selection and genetic correlation between early and lifetime performance traits. Keeping in view, the above facts available through the literature on this species of livestock indicated immense opportunities for the evaluation of genetic parameters and devising appropriate selection indices. The literature pertinent to genetic and phenotypic parameters of lifetime performance traits viz. number of lactations completed, herd life (days), lifetime milk yield (kg), productive life (days), milk yield per day of productive life (kg/day) and milk yield per day of herd life (kg/day) and non genetic factors affecting lifetime performance traits were reviewed in Murrah buffaloes.

Citation: Kapil Dev, Dhaka, S.S., Yadav, A.S., Patil, C.S. and Lalit, 2017. "Genetic parameters and effect of non genetic factors on lifetime performance traits of murrah buffalo: A review", *International Journal of Current Research*, 9, (10), 60106-60110.

INTRODUCTION

World buffalo population is estimated to be approximately 185.29 million spreading over 42 countries, of which 179.75 million (97 percent) are found in Asia, while approximately 5.54 million are found in rest of the world (FAO, 2008). India, with its 108.70 million heads of Buffalo (BAHS, 2014) has the largest Buffalo population in world, out of which 20% is comprised of Murrah. Although the proportion of buffaloes to cattle is 1:2, buffaloes contribute around 57 percent of the total milk production (DAHD-GOI-2012). The genetic worth of buffalo is primarily determined by her lifetime performance. This includes the ability to maintain high level of production for a longer period and more number of calving in her lifetime. Although lactation records are widely used in assessing the genetic merit of buffaloes but selection of dairy sires is invariably based on the first one or two lactation records in most of the breeding programmes (Kuralkar and Raheja, 1997). It is a established fact that first lactation yield is a good indicator of lifetime performance but still there is further need to study the relationship between first, later lactations and lifetime performance traits for overall better evaluation of genetic worth of the female individual's own performance and for ranking of sires. First lactation has positive genetic and phenotypic correlations with all other first lactation traits and values varied from low to medium. These results suggested that selection on basis of FLMY would be expected to improve lifetime performance traits in cattle (Singh *et al*., 2008). There are several non-genetic factors which introduce biasness in the estimation of genetic value of performance traits. The non-genetic factors such as management, amount and quality of feed, season etc. also influence milk yield and lactation length, and need to be assessed in a production set up. This will help to formulate suitable evaluation procedures especially in organised farms for improving economic traits of this breed. The literature pertinent to the genetic and phenotypic parameters of lifetime performance traits and non genetic factors affecting can be reviewed as under.

***Corresponding author: Kapil Dev,**
Department of Animal Genetics and Breeding, LUVAS, Hisar-125004.

Life time traits

The lifetime production performance is a reflection of both productive and reproductive efficiency of farm animal and help in evaluating relative merit and demerits of different breeds maintained under varied agroclimatic conditions. Further, longer herd life increases the total calf crop production and lifetime milk production permitting high intensity of selection.

Little information is yet available of lifetime performance of Murrah buffaloes. The averages for life time performance traits of Murrah buffaloes are summarised in Table 1.

(A) Averages of lifetime performance traits and factors affecting lifetime performance traits

Number of lactations completed: Varying reports are available in literature on number of lactations considered for definition of lifetime milk production. For example, Kuralkar and Raheja (1997) defined the lifetime milk production as the sum of three lactation yields. In Europe and North America generally, first five lactations are considered for lifetime productivity for selection of bulls and cows. Thus there is need to determine number of lactations to be included for prediction of lifetime performance. Various reports revealed that number of lactations completed (NLC) varied from 3.72±0.02 (Kuralkar and Raheja, 1997) to 6.30±0.11 (Dutt *et al.,* 2001) in Murrah buffaloes.

Effect of period of calving: The significant effect of period of calving on NLC was reported by Kaushik *et al*. (1994) and Kuralkar and Raheja (1997).

Effect of season of calving: Kaushik *et al.* (1994) reported non-significant effect of season of calving on NLC. Kuralkar and Raheja (1997) reported significant effect of season of calving on NLC.

Effect of age at first calving: Thiruvenkadan *et al.* (2015) reported significant effect of AFC on number of lactations completed in Murrah buffaloes.

Lifetime milk yield (LTMY): Buffaloes are not kept in herd until their natural death, Calculation of milk production for whole life is not possible in practice. Different criteria has been used for estimating lifetime milk production in dairy animals. Sharma *et al.* (1994) calculated lifetime milk yield as measured by yield upto five lactation in Murrah buffaloes. Sharma and Basu (1985) and Dutt and Taneja (1994) utilized the criteria of milk yield up to disposal or death for estimation of lifetime milk yield in murrah buffaloes. Kuralkar and Raheja (2000) defined lifetime milk yield as the total amount of milk produced by buffalo during the period she stayed in the same herd. Alli *et al.* (2000) measured the lifetime milk yield up to 3 and 4 lactation in Murrah buffaloes. The lifetime milk yield reported in literature (Table 1) ranged from 5381.07±66.03 kg (Kumar *et al.,* 2015) to 10970±286 kg (Dutt *et al.,* 2001).

Effect of period of calving: Significant effect of period of calving on LTMY was reported by Dutt and Taneja (1994), Dutt *et al.* (2001) and Godara (2003) in Murrah buffaloes. While non-significant effect of period of calving on LTMY was reported by Dev (2015) in Murrah.

Effect of season of calving: Significant effect of season of calving on LTMY was reported by Tailor *et al.* (1998) in Surti buffaloes, whereas non-significant effect of season of calving on the same trait was reported by Dutt *et al.* (2001) Godara (2003) and Dev (2015) in Murrah buffaloes.

Effect of age at first calving: Significant effect of AFC on LTMY was reported by Thiruvenkadan *et al.* (2015). Non-significant effect of AFC on LTMY was reported by Godara (2003) and Dev (2015).

Productive life: The sum of number of days in milk in different lactations in the herd.

Table 1. Estimates of Least square means and heritability of lifetime performance traits of Murrah buffaloes

Traits	N	Means ± S.E	h2±S.E	References
NLC	1647	----------	0.17±0.07	Dutt and Taneja (1994)
	2107	3.72±0.02	0.05±0.04	Kuralkar and Raheja (1997)
	1164	6.30±0.11	--------	Dutt *et al.* (2001)
	755	3.00±0.08	----------	Thiruvenkadan *et al*. (2015)
LTMY (Kg)	2107	5588±40.20	0.17±0.05	Kuralkar and Raheja (1997)
	1164	10970±286.0	------	Dutt *et al.* (2001)
	230	6765.28±274.06	0.18±0.06	Godara (2003)
	1037	7722.9±163.7	0.09±0.05	Bashir *et al.* (2007)
	1213	5630.00±1383.88	0.19±0.07	Singh and Barwal (2012)
	1753	5381.07±66.63	----------	Kumar *et al.* (2015)
	553	5441.6±206.0	----------	Thiruvenkadan *et al.* (2015)
	171	8607.93±481.93	0.18±0.10	Dev (2015)
PL (days)	351	1261.79±24.48	0.21±0.11	Chander (2002)
	230	1017.20±35.88	0.14±0.05	Godara (2003)
	664	1520.7±46.2	--------	Thiruvenkadan *et al.* (2015)
	171	1161.59±54.17	0.26±0.17	Dev (2015)
MY/PL (kg/day)	210	6.19±1.30	--------	Sharma *et al.* (1994)
Up to 5th lactation	2107	----------	0.10±0.04	Kuralkar and Raheja (1997)
	351	5.76±0.04	0.21±0.11	Chander (2002)
	509	2.89±0.05	-----	Thiruvenkadan *et al.* (2015)
	171	5.59±0.15	0.11±0.04	Dev (2015)
HL (days)	1164	3951±54.30	------	Dutt *et al.* (2001)
Up to disposal	351	2050.42±32.08	0.09±0.04	Chander (2002)
	1037	------	0.01±0.06	Bashir *et al*. (2007)
	664	3078.4±46.30		Thiruvenkadan *et al.*(2015)
	171	3340.22±120.67	0.26±0.20	Dev (2015)
MY/HL (kg/day)	2107	2.58±0.02	0.05±0.04	Kuralkar and Raheja (1997)
	1164	2.60±0.04	------	Dutt *et al*. (2001)
	1753	4.77±0.04	-------	Kumar *et al.* (2015)
	509	1.41±0.04	-------	Thiruvenkadan *et al.* (2015)
	171	2.55±0.10	0.20±0.24	Dev (2015)

The averages for number of days in milk ranged from 1017.20±35.88 days (Godara, 2003) to 1520.7±46.2 days (Thiruvenkadan *et al.,* 2015) in Murrah buffalo.

Effect of period of calving: Dutt and Taneja (1994) and Godara (2003) reported significant effect of period of calving on PL. While non-significant effect of period of calving on PL was reported by Dev (2015).

Effect of season of calving: Significant effect of season of calving on PL was reported by Godara (2003), however non-significant effect of season of calving on PL was reported by Dutt and Taneja (1994) and Dev (2015).

Effect of age at first calving: Thiruvenkadan *et al.* (2015) reported significant effect of AFC on PL in Murrah buffalo, while, non-significant effect of AFC on PL was reported by Godara (2003) and Dev (2015).

production efficiency in different ways. Kalsi and Dhillon (1984) defined it as milk yield per day of total lactation period in Murrah buffaloes. Umrikar and Deshpande (1985) defined it as milk yield per day of productive life. Biradar *et al.* (1991) and Sharma *et al.*(1994) defined it as life time milk yield per day of lactation length in Murrah buffaloes. The average value of MY/PL ranged from 2.89±0.05 kg/day (Thiruvenkadan *et al.,* 2015) to 6.19±1.30 kg/day (Sharma *et al.,* 1994) in Murrah buffalo.

Effect of period of calving: Dutt and Taneja (1994) and Dev (2015) reported significant effect of period of calving on MY/PL.

Table 2. Genetic and phenotypic correlations among lifetime performance traits

Correlation		References	Breed
Rg±s.e	Rp±s.e		
LTMY with PL			
0.91±0.46	0.94±0.06	Chander (2002)	Murrah
0.25±0.013	0.87	Bashir *et al*. (2007)	Nilli Ravi
0.88±0.08	0.90±0.08	Dev (2015)	Murrah
LTMY with NLC			
-0.56±0.39	-0.13	Kuralkar and Raheja (1997)	Murrah
----	0.926±0.019	Thiruvenkadan *et al*. (2015)	Murrah
LTMY with MY/PL			
0.87±0.11	0.55	Dutt and Taneja (1994)	Murrah
---	0.630±0.039	Thiruvenkadan *et al*.(2015)	Murrah
0.87±0.13	0.59±0.13	Dev (2015)	Murrah
LTMY with HL			
0.97±0.45	-0.71±0.04	Chander (2002)	Murrah
0.20±0.01	0.70	Bashir *et al*.(2007)	Nilli-Ravi
0.50±0.22	0.79±0.22	Dev (2015)	Murrah
and, **LTMY with MY/HL**			
0.25±0.23	0.10	Kuralkar and Raheja (1997)	Murrah
---	0.935±0.018	Thiruvenkadan *et al*.(2015).	Murrah
0.70±0.15	0.74±0.15	Dev (2015)	Murrah
PL with NLC			
0.97±0.03	0.94	Dutt and Taneja (1994)	Murrah
0.692±1.651	0.920±0.017	Thiruvenkadan *et al*.(2015)	Murrah
PL with MY/PL			
0.55±0.23	0.23	Dutt and Taneja (1994)	Murrah
-----	0.432±0.046	Thiruvenkadan *et al*.(2015)	Murrah
0.57± 0.24	0.42±0.24	Dev (2015)	Murrah
PL with HL			
0.25±0.23	0.10	Kuralkar and Raheja (1997)	Murrah
>1	0.77±0.01	Chander(2002)	Murrah
0.67±0.19	0.80±0.19	Dev (2015)	
PL with MY/HL			
0.90±0.07	0.63	Kuralkar and Raheja (1997)	Murrah
------	0.851±0.027	Thiruvenkadan *et al.* (2015)	Murrah
0.49±0.24	0.20±0.24	Dev (2015)	Murrah
MY/PL with HL			
0.97±0.68	0.68±0.01	Chander (2002)	Murrah
0.07±0.24	0.35±0.24	Dev (2015)	
MY/PL with MY/HL			
0.19±2.502	0.781±0.031	Thiruvenkadan *et al*. (2015)	Murrah
0.83±0.09	0.56±0.09	Dev (2015)	Murrah
MY/PL with NLC			
-----	0.539±0.043	Thiruvenkadan *et al* (2015)	Murrah
HL with MY/HL			
-0.58±0.26	-0.10	Kuralkar and Raheja (1997)	Murrah
0.20±0.24	0.25±0.24	Dev (2015)	Murrah

Milk yield per day of productive life: It is a production efficiency trait. It was measured as life time milk yield divided by the productive life. Different workers defined this

Effect of season of calving: Reddy and Nagarcenkar (1988) and Dev (2015) reported non-significant effect of season of calving on MY/PL.

Effect of age at first calving: Non-significant effect of AFC on MY/PL was reported by Thiruvenkadan *et al.* (2015) and Dev (2015).

Herd life: Different workers defined herd life in different ways. Kalsi and Dhillon (1982) defined herd life as the age at last calving of the herd. Sharma and Basu (1986) defined herd life as the period between date of first calving and last calving. Kuralkar and Raheja (2000) defined herd life as the total number of days from first calving to date of death or disposal from the herd. The average herd life reported in the literature (Table 1) ranged from 2050.42±32.80 days (Chander, 2002) to 3951±54.30 days (Dutt *et al.,* 2001).

Effect of period of calving: Significant effect of period of calving on HL was reported by Dutt and Taneja (1994) and Dutt *et al.* (2001). While non significant effect on HL was obtained by Dev (2015).

Effect of season of calving: Non-significant effect of season of calving on HL was reported by Dutt and Taneja (1994), Dutt *et al.* (2001) and Dev (2015).

Effect of age at first calving: Significant effect of age at AFC on HL was reported by Thiruvenkadan *et al*. (2015). While non-significant effect of AFC on HL was reported by Dev (2015).

Milk yield per day of herd life: It was measured as lifetime milk yield divided by herd life.The value of MY/HL ranged from 1.41±0.04 kg/day (Thiruvenkadan *et al.,* 2015) to 4.77±0.04 kg/day (Kumar *et al*., 2015).

Effect of period of calving: Significant effect of period of calving on MY/HL was reported by Dutt *et al.* (2001). While non-significant effect of period of calving on MY/HL was reported by Dev (2015).

Effect of season of calving on milk yield per day of herd life: Non-significant effect of season of calving on MY/HL was reported by Dutt *et al.* (2001) and Dev (2015).

Effect of age at first calving on milk yield per day of herd life: Non-significant effect of AFC on MY/HL was reported by Thiruvenkadan *et al*. (2015) and Dev (2015).

Heritability, genetic and phenotypic correlation among lifetime performance traits

Heritability and Genetic and phenotypic correlations among lifetime traits: Heritability of a character is function of total variability that is attributable to genes and their effects. Heritability estimates of traits are useful for construction of selection indices, prediction of genetic response to selection and for deciding how much one can rely upon individuals own phenotype for selection. Hence, accurate estimates of different economic traits are indispensable in animal breeding programmes. Heritabilty estimates of various lifetime performance traits in Murrah buffaloes are summarised in Table 2. The heritability estimates of NLC ranged from 0.05±0.04 (Kuralkar and Raheja, 1997) to 0.26±0.16 (Dutt and Taneja, 1994), LTMY ranged from 0.09±0.05(Bashir *et al.*, 2007) to 0.19±0.07 (Singh and Barwal, 2012) and the heritability estimates of PL ranged from 0.14±0.05 (Godara, 2003) to 0.26±0.17 (Dev, 2015). Heritabilty estimates of MY/PL ranged from to 0.10±0.04 (Kuralkar and Raheja, 1997) to 0.17±0.02 (Chander, 2002), HL ranged from 0.01±0.06 (Bashir *et al.,* 2007) in Nilli-Ravi buffalo to 0.26±0.20 (Dev, 2015) and the heritability estimates of MY/HL ranged from 0.05±0.04 (Kuralkar and Raheja, 1997) to 0.20±0.24 Dev (2015).Kuralkar and Raheja (1997) observed that heritabilities for lifetime production traits is lower than heritability estimates of first lactation traitsLow to moderate heritability estimates and larger generation interval encountered for lifetime performance traits donot hold much promise for enhancing lifetime performance through direct selection. But some emphasis should be given to longevity and lifetime milk yield in selection for dams of young bulls through indirect selection which would be based on earlier records. Furthermore, genetic and phenotypic correlation among lifetime performance traits have been reviewed in Table 2 revealed from moderate to high among lifetime performance traits indicated that selection based on any one of these traits could result into improvement through positive correlated response in all other traits.

Conclusion

The review of literature revealed that since selection on lifetime performance is not practically feasible due to long generation interval but lifetime performance traits should be included in selection criteria. The high to moderate heritability and correlations indicated that life-time milk yield, productive life and herdlife was a better representative trait among all lifetime performance traits. These results also suggested that selection of relatives on the basis of lifetime milk yield, productive life and herd life would lead to positive genetic responses and high genetic gain.

Acknowledgements

The authors express their sincere gratitude to the Vice Chancellor, LalaLajpatRai University of Veterinary and Animal Sciences, Hisar, Haryana and Head of the Department of Animal Genetics and Breeding for providing research facilities for the successful completion of this study.

REFERENCES

Ali, A., Z. Ahmad, G. Mohiuddin and K. Javed. 1999. Genetic and phenotypic relationship between age at first calving and some lifetime traits in Nili-Ravi buffaloes. *Pak. J. Biol. Sci.,* 1:211-213.

BAHS. 2014. Basic animal husbandry statistics, Department of animal husbandry, Dairying and fisheries, Ministry of agriculture. *Government of India. Krishibhawan*, New Delhi.

Bashir, M.K., Khan, M.S., Bhatti, S.A. and Iqbal, A. 2007. Lifetime performance traits of Nilli-Ravi buffaloes in Pakistan. *Asian-Aust. J. Anim. Sci.,* 20(5):661-668.

Biradar, U.S. 1990. Factors affecting peak yield and days to attain peak yield in Surti buffaloes. *Indian J. Dairy Sci*., 43: 32-34.

Chander, R. 2002. Prediction of the breeding value of sire's for life time performance traits in Murrah buffaloes. Ph.D. Thesis, Haryana Agricultural University., Hisar.

DAHD-GOI, 2012. Department of animal husbandry, Dairying and fisheries. Ministry of agriculture Government of India. Krishibhawan, New Delhi.

Dev, kapil 2015 Genetic evaluation of early and lifetime performance traits in murrah buffaloes. Mvsc Thesis, Lalalajpatrai university of veterinary and animal sciences, Hisar Haryana-124004.

Dutt, T, Bhushan, B and Kumar, S. 2001. First lactation and lifetime performance traits in Murrah buffaloes. *Indian J. Anim. Sc.,* 71(5): 483-484.

Dutt, T. and Taneja, V.K. 1994. Estimates of phenotypic and genetic parameters on lifetime performance traits in Murrah buffaloes. *Indian J. Anim. Sci.,* 64: 384-387.

FAO. 2008. Food and Agriculture organization. Production Year Book. Rome, Italy.

Godara, A. 2003. Genetic studies on performance traits in different lactation of Murrah buffaloes. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, India

Kalsi, J. N. and J. S. Dhillon. 1982. Performance of buffaloes in first three lactations. *Indian J. Dairy Sci.* 35(2):218-219.

Kaushik, S.N., Agarwal, S.C and Garg, R.C. 1994. Lifetime traits in Hariana cattle. *Indian J. Anim. Sci.,* 64: 1104-1107.

Kumar, S., Yadav, M.C., Singh, B.P and Prasad, R.B. 2015. Relative importance of reproductive traits in lifetime milk production and profit in buffaloes. E-Bulletin http://ibic.ku.ac.th.

Kuralkar, S. V. and Raheja, K. L. 1997. Relationship among early performance, lifetime production and reproduction traits in Murrah buffaloes. *Indian J. Anim. Sci.,* 67:798-801.

Reddy, K.M. and Nagarcenkar, R. 1988. Studies on lifetime traits in Sahiwal cattle. *Indian J. Dairy Sci.,* 41:66-77.

Sharma, A. and S. B. Basu. 1985. Genetic architecture of Nili buffaloes. *Indian J. Anim. Sci.,* 55(12): 1046-1049.

Sharma, I.H., Singh, H. and Parsad, R.B. 1994. Effect of breeding efficiency on production traits in Murrah buffaloes. *Indian J. Anim. Sci.,* 47: 973-975.

Singh, C.V and Barwal, R.S. 2012. Use of different animal models in prediction of genetic parameters of first lactation and herd life traits of Murrah buffaloes. *Indian J. Dairy Sci.,* 65(5): 399-404.

Singh, V. K.; Singh, C. V.; Kumar, D. and Sharma, R .J. 2008. Genetic parameter for first lactation and lifetime performance traits in crossbreed cattle. *Indian J. Anim. Sci.,* 78(5):479-401.

Tailor, S. P., O. P. Pathodiva, L. S. Jain and B. Singh. 1998. Inheritance of lifetime production and a suitable selection. BubalusBubalis. 4(4):69-72.

Thiruvenkadan, A.K., Panneerselvam, S. and Rajendran, R. 2015. Lifetime performance of Murrah buffaloes hot and humid climate of Tamil Nadu, India. *Buffalo Bulletin (March 2015)* Vol.34 No.1.

Umrikar, U.D. and Deshpande, K.S. 1985. Factors affecting milk yield per day of age at second calving in Murrah buffalo. *Indian J. Dairy Sci.,* 38: 349-351.

****